

MAXIMUM CONSTITUENT LEVELS  
IN THE  
GULF COOPERATION COUNCIL COUNTRIES

I. SUMMARY

In January 1986, the Arab Gulf States Health Ministers Council adopted a resolution to limit the maximum "tar" and nicotine deliveries of cigarettes to 12 mg. and 0.8 mg. respectively. These limits were later established in most member countries' cigarette specifications. More recently the Council's Bureau meeting in Riyadh on January 8-10, 1990 recommended that the Council's Anti-Smoking Committee should study the possibilities of further reductions in the maximum allowable deliveries of "tar" and nicotine to the lowest possible levels.

This latest recommendation of the Council's Bureau indicates that the Arab Gulf Health Ministers continue to support reductions in maximum "tar" and nicotine levels as part of its declared objective of "reducing the health hazards of smoking". By its very nature, this stated objective suggests that in the opinion of these officials there is a perceived health benefit from smoking cigarettes with lower "tar" and nicotine deliveries. This hypothesis is not supported by tobacco science.

Although tobacco smoke constituents are among the most heavily researched substances in the world, no smoke constituent as found in cigarette smoke has been scientifically proven to cause cancer or any other human disease. Nor has any health benefit from switching to low "tar" and nicotine cigarettes been scientifically established.

Anti-smoking advocates frequently assert that "tar" and nicotine cause disease in humans, particularly implicating "tar" in the development of cancer and nicotine as having a primary role in the development of heart disease. In their assertions, anti-smokers rely on data and findings that have been widely contested and that can at best be described as inconclusive. Section II provides a review of the major research and epidemiological studies that have cast serious doubts on the validity of such "evidence" which is cited in support of mandating limits on "tar" and nicotine deliveries of cigarettes.

Given the lack of reliable scientific proof regarding the alleged health effects of "tar" and nicotine, the imposition of mandatory maximum limits for these constituents can be misleading to consumers, as it suggests that government sanctions the low-yield cigarette as a "safer" cigarette even though there is no scientific data to support this suggestion. It should be noted that Philip Morris does not represent low "tar" and nicotine cigarettes as being "safer". These are on the market in response to consumer demand, which has increased in recent years. Because of these changes in consumer preferences, manufacturers have modified their production and shifted their emphasis in advertising. The current popularity of some low "tar" and nicotine brands is consistent with trends in consumer preference for many products. Consumer tastes are changing, as demonstrated by the growing demand for lighter products such as low-calorie beers, sugar-free soft drinks, low-fat foods and the like. In addition, only the views of scientists who favour reductions in maximum constituent

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limits have been given media attention. As a result, it is entirely possible that some smokers have been influenced by such publicity.

Unsuccessful attempts by researchers to demonstrate any health benefits from switching to low-yield cigarettes (see section III.B) have been further complicated by the uncertainties involved in measuring the exposure of smokers to smoke constituents. "Tar" and nicotine levels appearing on packets are obtained by smoking cigarettes mechanically under a set of defined laboratory conditions. While laboratory measurements are adequate for the particular purpose of ranking cigarette brands, they are not sufficient for the accurate measurement of the smoke delivery to an individual smoker. This is because many factors that vary considerably among smokers cannot be controlled in the laboratory. These include the number of cigarettes smoked per day, the frequency of puffs, the depth and degree of inhalation and the length that each cigarette is smoked (i.e. the butt length).

Another complicating factor stems from the likelihood that changes in cigarette engineering are accompanied by changes in smoking behaviour including the tendency of smokers to increase the amount they smoke by inhaling more deeply when they switch to low-yield cigarettes, by smoking further down the "rod" of the cigarettes, or by shortening the interval between puffs. This hypothesis would suggest that the use of low-yield cigarettes does not reduce exposure to smoke.

There is no reliable scientific basis for imposing maximum tobacco smoke constituent levels. The claims posited by proponents of such maximum levels that low-yield cigarettes are preferable, from a public health standpoint, to other cigarettes are no more well founded than the claims that particular smoke constituents have been determined to cause the alleged health risks of smoking. The imposition of maximum constituent levels gives governmental sanction to the "benefits" of low-yield cigarettes posited by the maximum constituent level advocates and thus misleads consumers by suggesting that a reliable scientific basis exists for switching to low-yield cigarettes, when no such basis exists.

## **II. THE SCIENTIFIC LITERATURE DOES NOT SUPPORT THE IMPOSITION OF MAXIMUM CONSTITUENT LEVELS**

Tobacco smoke is a highly complex mixture containing thousands of constituents. Although tobacco smoke constituents are among the most heavily researched substances in the world, no constituent found in cigarette smoke has been scientifically proven to cause cancer or any other human disease. Nor has any "health benefit" from switching to low "tar" and nicotine cigarettes been scientifically established. Thus, legislation establishing maximum levels of "tar" and nicotine deliveries in cigarettes for smoke constituents is insupportable on scientific and public health grounds.

Anti-smoking advocates frequently assert that nicotine causes disease in humans. The same is also said about "tar" even though it is not an actual constituent of tobacco smoke. "Tar" is actually a laboratory product obtained by collecting the particulate matter in tobacco smoke, either by passing cigarette smoke through a cold trap at extremely low temperatures or by using filters and a drying process. Over the years much time and effort has been devoted to determining the identity of tobacco smoke constituents. This has proven difficult, however, and much remains to be

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learned about the structure and makeup of tobacco smoke and its effects, if any, on human health. Nonetheless, certain countries have set maximum allowable levels of "tar" and nicotine deliveries for cigarettes including the Gulf Cooperation Council countries where the levels enforced are among the lowest in the world.

The imposition of such limits is not supported by the available scientific data. This is because the significance of smoke constituents to human health is not yet understood and "no ingredient (constituent) or group of ingredients (constituents) as found in tobacco smoke have been established as disease producing in smokers" (1) nor has it been proven that a reduction in the levels of those substances will decrease any claimed harmful effects of cigarette smoke. A review of the available scientific information and research on the two major constituents of tobacco smoke, "tar" and nicotine, will help demonstrate the lack of any scientific basis for mandatory limits on deliveries of these constituents in cigarettes.

#### A. Nicotine

Nicotine is a natural element of tobacco and, thus, is present in tobacco smoke. Nicotine has been described as having no known chronic or cumulative effects on human health. (2) The data on the nature of nicotine's relationship to human health is inconclusive at best. Exposure of smokers to nicotine cannot be measured with precision, so that it is impossible to establish a scientific relationship between nicotine exposure and any other (precise or imprecise measurement). In fact, no correlation between the nicotine level of a cigarette or the number of cigarettes smoked and the smoker's actual nicotine intake has been established because of individual variations in puff rates, depth of inhalation, and body metabolism. (3)

Nonetheless, anti-smoking advocates blame nicotine for the development of heart disease. Yet no mechanism by which nicotine, or any other tobacco smoke constituent, is involved in heart disease has been demonstrated. Serious questions about what role, if any, nicotine plays have been raised as a result of autopsy findings of fatty deposits and other changes in the arteries of individuals who either have not smoked or could have smoked only briefly, such as infants, children, and young men killed in battle. (4) Even the 1983 U.S. Surgeon General's Report, which focused on cardiovascular disease, concedes that "the evidence for and against a primary role for nicotine in the development or acceleration of atherosclerosis is not conclusive". (5) That opinion was shared by a German researcher, H. Schievelbein, who has conducted research on the relationship between nicotine and the clogging of arteries. After reviewing the literature, H. Schievelbein and his co-author G. Heinemann concluded that "there is no established evidence which supports the hypothesis that nicotine has any influence on the development" of those changes. (6)

The role of nicotine in the development of heart disease posited by anti-smoking advocates is further undermined by two epidemiological (population) studies. In a study that dealt with myocardial infarction (heart attack), the authors reported finding -- contrary to what they expected -- that the nicotine levels of the cigarettes smoked by their subjects were not related to the risk of heart attack (7).

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The second study, chaired by N. Wald, a well-known British scientist opposed to cigarette smoking, examined the serum (blood) levels of cotinine, a nicotine metabolite, in male nonsmokers and smokers of cigarettes only, cigars only, and pipes only. The study determined that the mean cotinine level for pipe smokers was significantly higher than the levels for cigarette and cigar smokers. Since studies of pipe smokers generally have not reported an increased risk of coronary heart disease, the researchers concluded that "nicotine is unlikely to be the major cause of the excess coronary heart disease mortality in cigarette smokers." (8).

After re-evaluating their methodology in response to anti-smoking criticism of their study, the researchers again concluded, "We can be reasonably confident that exposure to high systemic concentrations of nicotine is not a cause of the disease." Although the researchers argued that their data "cannot completely exonerate" nicotine, they added that the data do "substantially reduce the weight of evidence suggesting that nicotine is a cause of coronary heart disease." (9)

Animal studies which purport to establish a causal role for nicotine in heart disease have been soundly criticised for their unrealistic and excessive test conditions. An American researcher, E. Fisher, who conducted animal studies on this subject has noted :

"There have been some studies that have exhibited minor or questionable changes with the use of 600 or more cigarettes a day in man. This is such a large number that I think man would find it difficult to find the time to smoke them." (10)

In contrast, animal studies using realistic doses of nicotine have "failed" to initiate, exacerbate, or otherwise influence the process leading to the clogging of arteries in test animals. (11) In one such study, which was funded by the United States government, male beagle dogs fed a special diet to induce this process were exposed for two years to cigarette smoke containing low or high levels of nicotine and, in some cases, enriched with carbon monoxide. According to the final report of the research laboratory which conducted the study, "the results of this study lent no support to the suggestion that cigarette smoking increases the rate of development" of this process. (12)

The foregoing authorities demonstrate the validity of one researcher's summary : "While many studies have been done in this field, none have established nicotine as contributing to the causation, aggravation or precipitation of any cardiovascular disease." (13)

B. "Tar"

"Tar" is not actually in tobacco smoke, although the many inaccurate references to "tar" present in smoke may have created that impression. "Tar" is actually a laboratory product obtained by collecting the particulate matter in tobacco smoke, either by passing cigarette smoke through a cold trap at extremely low temperatures or by using filters and a drying process. However, material collected in this way does not duplicate what humans are exposed to when they smoke :

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"[T]here is, at present, no available instrumentation permitting the separation and individual collection of the particulate and gas phases which duplicates the precise physicochemical conditions prevailing in cigarette smoke as it is inhaled." (14)

Despite its lack of relevance to smoking, laboratory-produced "tar" has been used in animal experiments designed to investigate the possible relationship between tobacco smoke and cancer. In those experiments, "tar" was repeatedly painted on the shaved backs or ears of test animals over prolonged periods of time. These so-called skin-painting experiments have prompted a great deal of interest, as the tumours which resulted have been said to be evidence that tumours might develop in human lungs from inhaling cigarette smoke.

The results of such animal experiments cannot and should not be extrapolated to the human situation. Even if the "tar" collected by the methods described above were present in cigarette smoke, the "tar" used in skin painting experiments is very different by the time it is studied in the laboratory. That is because after "tar" is collected, it continues to undergo chemical changes as long as it is stored. (15) The chemical and physical changes brought about in collecting "tar" and applying it to animals may well produce biological results quite different from any that may occur during inhalation. Furthermore, as an experimental toxicologist, C. Hine, explained in hearings before the United States Senate in 1976, even if an effect such as tumour production is observed in a particular species, that does not necessarily mean that it might "occur either quantitatively or qualitatively in man". (16) Skin painting experiments suffer from a number of additional weaknesses. For example, the concentrations of "tar" used in such experiments are extremely high. One researcher, I. Macdonald, has estimated the amounts utilised to be equivalent to an individual smoking over 100,000 cigarettes per day. (17) Furthermore, the skin and ears of laboratory animals are not similar to human lung tissue. Animal skin lacks the intricate clearance mechanisms of the lungs, such as the mucus blanket which coats the lining of the major airways of the lung. Even the summary report of a study sponsored by the United States government utilising skin painting techniques conceded that there is an "uncertain relationship between tumors resulting from mouse skin painted with condensate and human lung cancer". (18) Consequently, such experiments involve applying "the wrong material, in the wrong form, in the wrong concentration, to the wrong tissue of the wrong animal" (19).

It is misleading, therefore, to draw definitive conclusions about "tar" and human disease from skin painting studies. As a knowledgeable observer of research in this area has stated : "Bronchogenic carcinoma (lung cancer) has never been produced by tobacco or its products in any experimental animal despite the multiplicity of attempts." (20) All in all, the current state of scientific evidence concerning "tar" was concisely summarised by R. Okun as follows :

"Human beings do not smoke "tar" and laboratory reports on "tar" yields have not been established as significant to human health". (21)

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**III. MANDATORY REDUCTIONS IN MAXIMUM ALLOWABLE TAR AND NICOTINE  
MISLEAD CONSUMERS BY SUGGESTING THAT CERTAIN TYPES OF  
CIGARETTES ARE "SAFER" THAN OTHERS.**

Despite the lack of reliable scientific proof regarding the alleged health effects of "tar" and nicotine, the health authorities in Gulf Cooperation Council countries have proposed and enacted regulations that limited the maximum allowable deliveries of "tar" and nicotine in cigarettes and required that "tar" and nicotine levels be shown on cigarette packs. They have also publicly encouraged smokers to switch to the so-called low-yield cigarettes. As a result, some smokers have been led to believe that smoking low "tar" cigarettes is preferable to smoking higher "tar" cigarettes. Such belief, however, is without scientific foundation. A British toxicologist, A. Worden, has noted that scientific data to support such government action are not available :

"The toxicologist who seeks an objective basis upon which to predict increased "safety" or reduced "hazard" for tobacco products lacks the necessary quantitative experimental or clinical evidence to enable him to approach this task on the basis of the toxicology of any specific constituents of tobacco or tobacco smoke" (22)

Governmental sanction of the low-yield cigarette suggests to consumers that a reliable scientific basis exists for switching to it. This is not true.

**A. Machine Measurements and Human Smoking Behaviour**

Technical and scientific uncertainties abound regarding the low-yield cigarette. These begin with the popular but scientifically incorrect notion that the exposure of smokers to various cigarette smoke constituents has been determined by laboratory analysis. However, as researchers have pointed out, laboratory procedures cannot faithfully duplicate smoking as it actually takes place outside of the laboratory. There are simply too many uncontrolled factors which vary considerably among smokers and even in individual smokers, including the number of cigarettes smoked per day, the frequency of puffs, the depth and degree of inhalation and the length that each cigarette is smoked (i.e., the butt length). (23) In contrast, "tar" and nicotine levels appearing on packets are obtained by smoking cigarettes mechanically under a set of defined laboratory conditions.

The machines used for these laboratory measurements are designed to compare cigarette brands in their smoke yields. Such comparisons require controlling besides....brand differences... some of the various factors noted above. However, such precautions which are adequate for the particular purpose of ranking cigarette brands are not sufficient for the accurate measurement of the smoke delivery to an individual smoker, because of further factors which cannot be controlled.

This situation was summarised in a statement which appeared in the 1981 U.S. Surgeon General's Report :

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"The methods used in testing cigarettes by machine may not correspond to the way persons actually smoke. There is evidence to suggest that cigarette yields measured by machine are very different from the yields that the consumer actually obtains by smoking the cigarette, due in part to the difference in patterns of smoking between testing machines and individual smokers." (24)

The Report addressed such difficulties in a series of research recommendations it made on this subject and noted that since smokers may smoke different cigarettes in different ways, "it is important to know how smokers consume each type of commercial cigarette" in order "to conduct meaningful assays of cigarette yields and of the biological activity of cigarette smoke." The Report asserts that "only when this information is available can smoking-machines be designed to yield the most accurate estimate of human dose." (25)

#### **B. Studies on Low-Yield Cigarettes and Disease Risk**

The widespread scientific disagreement regarding the significance of the available data on low "tar" cigarette is reflected by the published opinions on this subject. These differences of opinion are highlighted in the 1981 US Surgeon General's Report which focused on "the changing cigarette" and "the relative health effects of cigarettes with varying levels of "tar" and nicotine." (26) In the Report's preface, for example, a senior government official, J. Richmond, noted that over the years US public health officials had gradually assumed a "more cautious" attitude toward the low-yield cigarette; the 1981 Report, he noted, "suggests an even more cautious approach to the issue". (27) These concerns are reflected in the Report's conclusions and in the accompanying commentary by US health officials. In her introductory remarks to the report, for example, P. Harris, the head of the US Department of Health and Human Services (DHHS), stated :

"In preparing this report, the scientists and scientific agencies of this Department have reviewed all current scientific evidence and have concluded that the search for less hazardous cigarettes has not yielded a product which can be considered 'safe'". (28)

Subsequent reports of the Surgeon General have reiterated those conclusions. The 1983 report on cardiovascular disease noted that "epidemiologic evidence concerning reduced tar and nicotine or filter cigarettes and their effect on coronary heart disease is conflicting. No scientific evidence is available concerning the impact on CHD death rates of cigarettes with very low levels of tar and nicotine." (29) The 1984 report which examines the relationship between chronic obstructive lung disease and cigarette smoking also noted that "evidence is unavailable on the relative risks of developing chronic obstructive lung disease consequent to smoking cigarettes with the very low tar and nicotine yields of current and recently marketed brands". (30) Most recently, the 1989 US Surgeon General's Report concluded that "there is no clear evidence of substantial health

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benefits to consumers who switch to lower tar and nicotine cigarettes" as "there is no known safe level of tobacco product consumption". (31)

Other scientific groups who have reviewed the available data on the low-yield cigarette have also commented on its inconclusive nature. For example, a committee convened by an operating agency of the US National Academy of Sciences to analyse the data on "reduced tar and nicotine cigarettes" concluded that "the evidence for switching to lower T/N cigarettes is doubtful". The committee report explained that "while some large scale studies have suggested small gains in health due to using lower T/N (or filter rather than non-filter) cigarettes, other population-wide studies do not support this view". (32) Similarly, participants in an international workshop held to consider the advisability of a governmental "lower-tar policy" concluded with the following cautionary statement even as they encouraged the move toward lower "tar" yields :

"The public needs to be made aware of the uncertainties of the policy, particularly those arising from compensatory smoking, and also that the benefits of smoking lower-yield cigarettes can only be small compared with those of avoiding the smoking habit altogether" (33)

Furthermore, as already suggested, there is strong disagreement regarding the nature of the relationship between the low-yield cigarette and disease mortality. This disagreement stems from data collected from epidemiological (population) studies, clinical studies, autopsy reports and laboratory analyses. As to the population studies, a scientific committee studying "reduced tar and nicotine cigarettes" concluded, based on its analysis of available data on US respiratory system cancer mortality trends, that "it is not possible to credit lower T/N cigarettes up to 1975 with significantly improving" male respiratory system cancer mortality. (34)

Similar observations were made by a well-known U.S. anti-smoking researcher and his co-authors and a working group charged by the International Agency for Research on Cancer (IARC) to evaluate the carcinogenic risk of chemicals to humans. In their report, the U.S. researchers noted the "conflicting reports in the literature regarding the effect of the introduction of the filter cigarette, with the concomitant lowering of smoke yields, on the risk of lung cancer." (35)

Likewise, the IARC working group concluded "at present, only about 20 years after ... substantial modifications of cigarette manufacture were introduced in some countries," that "no direct comparison of the health effects of lifelong use of modified and unmodified cigarettes is possible." (36) Although they viewed the results of several studies as suggestive, they concluded that "the health benefits from the cessation of smoking, however, greatly exceed those to be expected from changes in cigarette composition." (37)

A similar view was expressed by a group following the mortality experience of the participants in one of the largest on-going epidemiological studies in the United States. Although they reported that the total death rates and death rates from CHD and lung cancer of

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the participants were "somewhat lower" from smokers of low "tar" cigarettes than "high" tar cigarettes, they concluded, "It is quite apparent that reduction in the tar and nicotine of cigarette smoke did not make cigarette smoking 'safe' for the men and women in this analysis, all of whom were over the age of 40 in 1959." (38)

More recent studies examining the relationship between low-yield cigarettes and disease rates continue to undermine the validity of the position of maximum constituent level advocates regarding the relative merits of low-yield cigarettes. For example, a review of four cross-sectional and five prospective studies regarding the evidence on the relationship between smoking low-yield cigarettes and chronic obstructive lung disease concluded that there was "none for an effect on mortality" from that disease. (39)

A 1989 report on the relationship between low-yield cigarettes and nonfatal myocardial infarction (heart attacks) in women also noted this lack of data :

"To date, there is little epidemiologic evidence available concerning the effect of smoking low-yield cigarettes on the risk of coronary heart disease."

The data underlying the study, whose authors express their opposition to smoking, do not support those who advocate maximum constituent levels; the women in the study who smoked low-yield cigarettes reportedly did not have a lower risk of a first nonfatal myocardial infarction than women who smoked higher-yield cigarettes (40).

Autopsy studies have also prompted criticism of the "conventional wisdom" about the health effects of the low-yield cigarette. In a well-publicised study published in 1979, an American pathologist and his co-authors compared specimens of bronchial epithelium obtained during the autopsies of about 150 regular cigarette smokers who died during the period 1955 to 1960 to those from about 180 smokers who died during 1970-1977. (41) In their study, they reported finding changes which they regarded as precancerous far more frequently in the smokers who died in the fifties than those in the seventies. They contended that this reduction in the latter group could be attributed to the decline in "tar" and nicotine levels over that same period of time. The article does not explain, however, why invasive or very early bronchial carcinoma was actually found more frequently in sections taken from low "tar"/nicotine smokers, than from high "tar"/nicotine smokers, although the number involved was very small. (42) Nor did the researchers explain why their overall conclusions are inconsistent with observed trends in lung cancer mortality rates. The lung cancer mortality rate should have fallen sharply in recent years, if their theory is correct. However, this is clearly not the case. The significance of these findings has been challenged for other reasons as well. For example, it has been reported that these same changes occur in non-smokers, (43) and one of the study's co-authors has conceded that they have been unable to show that these changes actually progress to lung cancer (44).

Experimental data also seems inconsistent with the concept of the low-yield cigarette as being "safer". A Finnish occupational health specialist, M. Sorsa, who recently reviewed the results of relevant laboratory studies was unconvinced by the data. In her review, she

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analysed data from mutagenicity tests which some contend provide a reliable short-term method of testing for substances capable of transforming human cells to malignant or cancerous ones. After analysing the data, she observed that "the experimental evidence on the mutagenic activity of cigarette smoke condensates produced from low-, medium- or high-tar cigarettes clearly shows, . . . , that the activity measured on a weight-for-weight basis is similar or possibly even higher in some very low-tar CSCs [cigarette smoke condensate]." Based on those results and the results of certain other tests, she concluded that "the issue of smoking-induced cancer in relation to reductions of tar in cigarettes is still controversial." (45)

Thus, there is no convincing evidence that the imposition of government-mandated maximum constituent levels will result in any health "benefits." Proposals to mandate maximum constituent levels lack a reliable scientific basis. For this reason, government regulations that limit constituent levels mislead smokers, in particular, young smokers, because they suggest that a reduction in the levels of certain constituents would decrease any claimed harmful effects of cigarette smoke. This possibility was noted by Dr. Matti Rimpela, a well-known antismoker, in a 1987 report on changes in Finnish adolescent health habits :

It is possible that the increased selection of "light" cigarettes has influenced older adolescents' smoking behavior. When the dangers of smoking are equated with tar content, a decrease in tar content can lead to the belief that cigarettes are less dangerous. (46)

#### IV. Disagreement on Cigarette Modification Among Anti-Smoking Researchers:

With so many fundamental research issues unresolved, it is not surprising that there are even differences of opinion regarding the basic design of a low-yield cigarette. Although some researchers favour reduced levels of "tar," nicotine and carbon monoxide, others advocate other approaches. A well-known British researcher, M. Russell, contends that "a low-tar medium-nicotine approach has enormous potential." (47) His views are generally compatible with those of a group of British researchers who contend their data are "consistent" with "the proposition that the middle tar smoking population at large might be exposed to lower concentrations of tar and carbon monoxide by smoking a product such as the one used in these experiments with a relatively high nicotine yield and low tar yield." (48) A group of American scientists, however, is "very much opposed" to that approach, contending it is "counter-productive." They favour the development of a low-"tar," low-nicotine cigarette. (49) The approach favoured by the U.K. group was also criticised by a well-known U.S. anti-smoking researcher at a conference called to discuss the question of "A Safe Cigarette?". Although he stated that such an approach is "a good idea with respect to tumorigenic activity," he contends "it is not known whether it is beneficial, or even benign, with respect to the cardiovascular system." (50) Another participant at the same conference, apparently concerned about the same question, advocated research into the

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development of "a medium-nicotine, low-tar, low-carbon monoxide (carbon monoxide) cigarette." (51)

A U.S. government sponsored and directed research programme charged with the "development of a less hazardous cigarette" attempted to resolve these and other questions. The group which oversaw the programme and which became known as the Tobacco Working Group (TWG) began meeting in 1968. It was composed of both tobacco industry and government specialists in a broad range of technical areas related to cigarette production, consumption and testing. Some years later, the TWG was incorporated into the National Cancer Institute's (NCI) Smoking and Health Programme (S&HP), where it assumed a broad advisory role. During that period, the research programme investigated many different cigarette variables, including modifications in cigarette design and smoke composition and changes in the processing of tobacco and the manufacturing of cigarettes. The tobacco companies continued to provide technical expertise to the programme during its existence. The programme in its entirety was eventually abandoned in 1979 after the expenditure of approximately \$32 million (U.S.). (52)

All the work carried out under the NCI's smoking and health programme was subsequently reviewed in the 1981 U.S. Surgeon General's Report. Based partially on this extensive research, the report concluded that "the search for less hazardous cigarettes has not yielded a product which can be considered 'safe'." (53)

The difficulties in evaluating data on the low-yield cigarette do not stop at differences of opinion regarding the levels of one, two or even more constituents. As another researcher in the area observed when he discussed this design question, changes in constituent levels present "a tricky problem of cigarette engineering" as "there is virtually no major manipulation that does not cause a major modification in one or another perceptible aspect of smoking." (54)

Among such modifications is the possibility expressed by some researchers that smokers who switch from high "tar" to low "tar" cigarettes might modify or change their smoking behaviour. This "compensatory smoking" hypothesis has been disputed by other researchers. The theory's adherents, however, contend that smokers tend to increase the amount they smoke by inhaling more deeply when they switch to low-yield cigarettes, by smoking further down the "rod" of the cigarettes, or by shortening the interval between puffs. (55) These researchers also suggest that individuals who smoke low-yield cigarettes may simply smoke more cigarettes. (56)

One British researcher recently summarised the "compensatory smoking" hypothesis as follows:

In general, a reduction in the tar yield of a cigarette is associated with a fall in its nicotine yield. Not surprisingly, therefore, when smokers switch from high to low yield cigarettes they often compensate by smoking more. They may simply smoke more cigarettes a day but -- unlike laboratory analytical smoking machines -- smokers may also vary the frequency and volume of puffing and so increase the yield from each cigarette. Alterations in the depth of inhalation may also influence the uptake of constituents of

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cigarette smoke. Nevertheless, the average smoker's compensation for reduced nicotine yields seems incomplete. Indices of exposure to tar and gaseous components of smoke seem to be lower when smokers switch from high to low yield cigarettes. (57)

An American researcher similarly admitted that "compensation" is "embarrassingly imperfect and incomplete to those of us trying to establish nicotine as the reinforcer in smoking" but suggested that "it may nevertheless mitigate the beneficial effects of smoking weaker cigarettes." (58) Another American researcher concluded that the "use [of low yield cigarettes] is not associated with substantially reduced smoke exposure...[because of] modification of puffing behaviour, depth of inhalation, [and] blocking of smoke-dilution holes of ventilated filters." (59) A study sponsored by the US National Research Council likewise suggested that changes in smoking behaviour "offset to some degree the expected reductions in nicotine and tar...[although] smokers may not absorb from the lower-yield brands all of the [tar and nicotine] previously absorbed from higher-yield brands." (60)

These studies have prompted public health officials in some countries to criticise the claim of maximum constituent level proponents that low-yield cigarettes are "safer" to the smoker. The U.S. Surgeon General, for example, has stated that "[c]ompensatory behaviour may negate any advantage of the lower yield product or even increase the health risk." (61) Likewise, a Finnish health official concluded that "low-tar cigarettes give a much higher yield of harmful components than has been presumed" because low-yield cigarettes are smoked more "intensively and efficiently" than high-"tar" cigarettes and are "more deeply inhaled." (62) The World Health Organisation recently pursued the same theme in a pamphlet for use in certain Middle East nations. This pamphlet advises smokers that low-yield cigarettes are no less dangerous than other cigarettes because "the smoker tends to compensate the loss in tar and nicotine by smoking more, [and] inhaling more deeply." (63)

On this question as on so many others pertaining to the low-yield cigarettes, however, the data are inconclusive and frequently contradictory. For example, while some researchers assert that switchers modify their smoking behaviour to maintain a certain level of nicotine (64), others have suggested the possibility that smokers may actually modify their smoking at least in part to increase their "tar" intake. (65) After analysing the latter report, the 1984 U.S. Surgeon General's Report commented, "It may be that nonpharmacologic, sensory stimulation by factors such as the flavour of the cigarette smoke may be more important than nicotine in determining smoking behaviour." (66) This comment is supported by another study published by the same researchers (discussed in the 1984 Report) following their long-term observation of such switchers. They reported that smokers who switched to cigarettes with lower levels of nicotine did not change their smoking patterns in such a way as to maintain the same level of nicotine they had absorbed before they switched. Thus, they suggested that any change in the smoking behaviour "was not determined by a need to maintain nicotine intake." (67) Two American researchers who have reviewed such research note that the data are "far from conclusive, and further research is definitely needed." They assert that "only sound methodological studies will lead to more definitive conclusions" regarding this hypothesis. (68)

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Such comments clearly demonstrate that there is no reliable scientific basis for imposing maximum tobacco smoke constituent levels. The claims of MCL proponents that low-yield cigarettes are preferable, from a public health standpoint, to other cigarettes are no more well founded than the claims that particular smoke constituents have been determined to cause the alleged health risks of smoking. The imposition of maximum constituent levels gives governmental sanction to the "benefits" of low-yield cigarettes posited by the advocates of such maximum levels. Further reductions in such maximum allowable levels will mislead consumers in the GCC countries by suggesting that a reliable scientific basis exists for switching to low-yield cigarettes. No such basis exists.

#### V. CONCLUSION

Numerous claims have been made about possible relationships between cigarette smoke constituents and the health of the smoker. However, such claims are just that -- claims which are not established scientifically. "Tar" is a laboratory product and not an actual constituent of tobacco smoke. Proponents of maximum constituent levels rely upon flawed animal experimentation in arguing that "tar" levels have relevance to the human situation. No definitive conclusions about "tar" and human disease can be drawn from skin painting studies -- these experiments involve applying "the wrong material, in the wrong form, in the wrong form, in the wrong concentration, to the wrong tissue of the wrong animal." (69)

Likewise, no relationship between the nicotine level of a cigarette or the number of cigarettes smoked and the smoker's actual nicotine exposure has been established because of individual variations in puff rates, depth of inhalation, and body metabolism. Thus, science has not been able to determine with any precision how much nicotine a smoker is exposed to. Epidemiological studies cannot demonstrate a causal role for nicotine in heart disease. Laboratory studies in this area are of questionable validity. As one researcher observed in regard to the conclusion of the 1981 Surgeon General's Report that changes in the composition of cigarettes over the last 15 years have not been related to declines in cardiovascular disease, this result is "clearly consistent with the proposition that amounts of tar, nicotine, and carbon monoxide in cigarette smoke have no demonstrable effects on coronary heart disease rates, and that these components of tobacco smoke are not proven etiologic (causal) agents." (70) Carbon monoxide, another constituent of cigarette smoke, is also accused by anti-smoking advocates of playing a role in the development of cardiovascular disease. The evidence for this is tentative, however, and has justly been described as "open to varying interpretations." (71)

Consequently, there is no convincing evidence that the imposition of government-mandated maximum constituent levels will result in any claimed health "benefits".

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END NOTES

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